U.S. NUCLEAR REGULATORY COMMISSION

Region I

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50320-820618
50320-820525
50320-820601
50320-820606

Report No. 50-320/82-07

Docket No. 50-320

License No. DPR-73 Priority -- Category C

Licensee: GPU Nuclear Corporation

P.O. Box 480

Middletown, Pennsylvania 17057

Facility Name: Three Mile Island Nuclear Station, Unit 2

Inspection At: Middletown, Pennsylvania

Inspection Conducted: May 23 - July 5, 1982

Inspectors: Joel S Wiebe for — 7/22/82
R. Conte, Senior Resident Inspector (TMI-2) — date signed

Barry O'Neill — 7/21/82
B. O'Neill, Radiation Specialist — date signed

L. H. Thomas — 7/21/82
L. Thomas, Resident Inspector (TMI-2) — date signed

Approved by: A. Fasano — 7/22/82
A. Fasano, Chief, Three Mile Island Section — date signed
Projects Branch No. 2

Inspection Summary:

Inspection conducted May 23 - July 5, 1982, (Inspection Report Number 50-320/82-07)
Areas Inspected: Routine safety inspection conducted by site inspectors of routine surveillance; axial power shaping rod movement; routine health physics and environmental areas; reactor building entries; radioactive material shipments; licensee event reports; and licensee action on NRC bulletins. The inspection involved 214 inspector-hours.
Results: No violations were identified.

Details

1. Persons Contacted

General Public Utilities (GPU) Nuclear Corporation

*S. Chaplin, Licensing Engineer
*J. Chwastyk, Plant Operations Director (Acting)
M. Herlihy, TMI-2 Startup and Test Manager
*C. Incorvati, Quality Assurance (QA) Auditor
*G. Kunder, Technical Specifications Supervisor
*E. Mitchell, QA Monitor
K. Harner, Chemistry Supervisor
J. Renshaw, Manager, Radiation Control Field Operations
J. Flanagan, Radiological Engineering Manager (Bechtel)
M. Pavelek, Entry Coordinator

Other licensee personnel were interviewed.

*denotes those present at the exit interview

2. Routine Plant Operations

Inspections of the facility were conducted to assess compliance with general operating requirements of TS 6.8.1 in the following areas: licensee review of selected plant parameters for abnormal trends; plant status from a maintenance/modification viewpoint including plant cleanliness; licensee control of ongoing and special evolutions including control room personnel awareness of these evolutions; control of documents including log keeping practices; and, area radiological controls.

Unannounced inspections of the control room during regular and back shift hours were conducted at least three times per week. Selected sections of the shift foreman's log and control room operator's log were reviewed for the period May 23 - July 5, 1982. Selected sections of other control room daily logs were reviewed for the period from midnight to the time of review. Inspections of areas outside the control room occurred on May 26 and 27 and June 2, 8, 23, and 29, 1982. Selected licensee planning meetings were also observed.

On June 1, 1982, a severe local thunderstorm occurred in the vicinity of the plant. Storm related effects included inoperability of the onsite meteorological instruments, leakage of rainwater into the auxiliary building and tripping of the fire protection system in the air intake tunnel (AIT).

The inoperability of the meteorological instruments was apparently due to a lightning strike. The damaged components were replaced and the instruments were returned to service within three hours of the occurrence. The rain water that leaked into the auxiliary building sump was pumped to the

miscellaneous waste holdup tank. The leak flow path was identified to be caused by a drain in the borated water storage tank (BWST) recirculation pump enclosure; the enclosure area was flooded due to the storm. The licensee initiated a prompt licensee event report (LER) to the NRC. The licensee is preparing a written followup report. This event will be reviewed separately by the NRC in conjunction with the in plant review of LERs.

The tripping of the fire protection system in the AIT was apparently due to a lightning strike actuating ultraviolet detectors and resulted in the tripping of the ventilation system, the actuating of the deluge system, and the discharge of the halon bottles. The ventilation system was restarted; the deluge water, which collected in the AIT sump, was pumped out and the halon bottles refilled. The AIT fire protection system was returned to service on June 12, 1982.

No violations were identified.

3. Routine Surveillance

Licensee implementation of Surveillance Procedure (SP) 4301-M11, Decay Heat Closed Cooling Water (DHCCW) Valve Lineup Check and SP 4303-M25, DHCCW Pump and Valve Operability, was observed on June 9, 1982. The procedures were reviewed and approved as required by Technical Specification 6.8.1.c and 6.8.2. Licensee personnel implementing the procedures were observed to be using controlled documents in accordance with Administrative Procedure (AP) 1001. The inspector also observed control room operators respond to alarms and their coordination with auxiliary operators.

No violations were identified.

4. Axial Power Shaping Rod Movement

a. Background

The Axial Power Shaping Rods (APSRs) are control rods which contain boron (a neutron absorber) in the lower one quarter of their length. They are moved within the vessel core to adjust the shape of the neutron flux when the reactor is at power. They do not serve a shutdown function and remain stationary when the reactor is tripped (shutdown). The APSRs at TMI-2 remained at approximately the 25% withdrawn position when the reactor tripped at the start of the March 28, 1979, accident.

In situ testing of the eight APSRs was conducted to attempt to fully insert these rods. If successful, this would facilitate decoupling the rods from the control rod leadscrews (threaded shafts) before

reactor vessel head removal. The licensee also accumulated data based on the movement characteristics of the APSR's which should help to assess damage to the reactor core and internal components.

The NRC TMI Program Office staff reviewed and approved the licensee's safety evaluation and associated implementing procedure for this evolution. The in situ testing occurred on June 23 through 25, 1982.

b. Review

The NRC site staff monitored the implementation of Maintenance Procedure 007 007 076 (Job Ticket C-9631), dated June 22, 1982, Dynamic in Situ Test of Axial Power Shaping Rod Drive Mechanisms, to verify the below listed items.

-- Proper implementation of the APSR test procedure

-- Adherence to administrative controls for procedure revision/changes

-- Data properly obtained and accurately recorded

Observations were made in the relay room (305' elevation of the control building) and in the control room.

c. Licensee Findings

Based on an initial review of data obtained, the following is a summary of "as left" rods/positions (percent withdrawn from core bottom): Rod No. 62, 5.3%; No. 63, 18.8%; No. 64, 25.0%; No. 65, 0.1%; No. 66, 4.2%; No. 67, 1.1%; No. 68, 22.9%; and, No. 69, 26.1.

No change in neutron population or reactor coolant fission product chemistry occurred as a result of the APSR testing. The above indicated positions represent the maximum achievable rod insertion, except rod No. 67. Rod No. 67 was left at the 1.1% position to avoid the rod becoming stuck at the bottom. The licensee is evaluating acoustic data along with the need for further APSR testing.

d. NRC Findings

No violations were identified.

5. Routine Health Physics and Environmental Review

a. Plant Tours

The NRC site radiation specialists completed routine plant inspection tours. These inspections included all control points and selected radiologically controlled areas. Observations included:

-- Access control to radiologically controlled areas

-- Adherence to Radiation Work Permit (RWP) requirements

-- Proper use of respiratory protection equipment

-- Adherence to radiation protection procedures

-- Use of survey meters including personnel frisking techniques

-- Cleanliness and housekeeping conditions

-- Fire protection measures

No violations were identified.

b. Measurement Verification

Measurements were independently made by the inspector to verify the quality of licensee performance in the following areas.

-- Radioactive material shipping

-- Radiological control, radiation and contamination surveys

-- Onsite environmental air and water sampling and analyses

A summary of the pertinent samples and analytical results for the Independent Measurement Verification Program is included as an Attachment to this report.

No violations were identified.

6. Reactor Building Entries

a. The site staff monitored reactor building (RB) entries conducted during the inspection period to verify the following on a sampling basis:

-- The RB entry was properly planned and coordinated for effective task implementation including adequate as low as is reasonably achievable (ALARA) review, personnel training, and equipment testing.

-- Proper radiological precautions were planned and implemented including the use of a Radiation Work Permit (RWP).

-- Specific procedures were developed for unique tasks and properly implemented.

b. The site staff attended RB entry status meetings; reviewed selected documents, applicable procedures, and RWPs concerning these entries.

Entries 63 through 69 were conducted during this inspection period.

Entry 63 conducted May 26, 1982
Entry 64 conducted June 3, 1982
Entry 65 conducted June 10, 1982
Entry 66 conducted June 17, 1982
Entry 67 conducted June 22, 1982
Entry 68 conducted June 23, 1982
Entry 69 conducted July 1, 1982

During these entries, technicians completed tasks to support the Axial Power Shaping Rod (APSR) movement which was completed on June 25, 1982, and successfully obtained a sludge sample from the 282' elevation (June 17, 1982). The technicians also obtained radiological survey data of the "A" and "B" D-Rings in preparation for the work involved with inserting a closed circuit television camera into the reactor through a control rod drive mechanism (the Quick Look Experiment tentatively scheduled for mid July 1982).

No violations were identified.

7. Radioactive Material Shipments

a. The NRC site radiation specialists inspected all radioactive material shipments during the inspection period to verify the items listed below.

-- Licensee had complied with approved packaging and shipping procedures.

-- Licensee had prepared shipping papers, which certified that the radioactive materials were properly classified, described, packaged, and marked for transport.

-- Licensee had applied warning labels to all packages and placarded vehicles.

-- Licensee controlled the radioactive contamination and dose rates below the regulatory limits.

b. Inspector review of this area consisted of: examination of shipping papers, procedures, packages, and vehicles; and performance of radiation and contamination surveys of each shipment.

During this period, 11 radioactive material shipments were made by the licensee.

No violations were identified.

8. Licensee Event Reports

a. The inspector reviewed a Licensee Event Report (LER) required to be submitted in accordance with Technical Specification (TS) 6.9.1.8 and .9 (and NUREG-0161) to verify the following: event and cause description clearly reported event information; the required LER form was properly completed; and adequate corrective action was specified.

Initial screening of each event was completed to determine generic applicability, need for additional site verification, and the necessity for additional NRC management review.

The below listed LERs were reviewed.

-- LER 82-13/03L-0 of April 28, 1982, Fire detectors failed to perform trip and alarm functions during surveillance testing

-- LER 82-15/01L-0 of June 18, 1982, Incore thermocouple failure

-- LER 82-16/03L-0 of May 25, 1982, Deluge sprinklers inoperable in hydrogen purge and auxiliary building (exhaust) ventilation system

-- LER 82-17/03L-0 of May 25, 1982, Potential reduction in sensitivity of air intake tunnel chlorine monitor

-- LER 82-18/03L-0 of June 1, 1982, Air intake tunnel halon system actuation, deluge system actuation and ventilation system trip

-- LER 82-19/03L-0 of June 1, 1982, Wind speed, wind direction, and air temperature instruments out of service

-- LER 82-21/03L-0 of June 6, 1982, Control room chlorine monitor inoperable

b. LER 82-13/03L-0 was reviewed in plant, to verify the following: The specified corrective actions including generic implications were either completed or scheduled and assigned to cognizant licensee personnel; the event did not involve an unreviewed safety question or continued operation in violation of regulatory requirements or license conditions; and, the report satisfied TS reporting requirements.

LER 82-13/03L described the failure of the reactor building (RB) fire detectors during surveillance testing on April 28, 1982. Investigation by the licensee determined that the cause was a degradation of high voltage power supply in the fire indicating unit (FIU) outside of the reactor building which controls the detectors. The FIU was replaced and the test of the detectors met the acceptance criteria of the surveillance test on May 26, 1982.

The inspector reviewed surveillance procedures (SPs) 4333-SA1, Fire System Detector Instrument Functional Test, Revision 3, dated May 14, 1982, and 4333-SA2, Fire Detection Circuits Operational Check, Revision 1, dated February 2, 1982. The data from the surveillance tests performed on April 28, 1982, and May 26, 1982 were also reviewed. The RB fire detectors had not been tested since prior to the March 1979 accident. The reason for not testing the detectors was based on personnel exposure considerations. Associated licensee as low as reasonably achievable (ALARA) exposure evaluations were also reviewed.

No violations were identified.

9. NRC Bulletin

The inspector reviewed the status of licensee response to NRC Bulletin 81-03, which is applicable to current plant conditions. The review included licensee implementation and adequacy of actions and the use of administrative controls.

(Closed) Bulletin 81-03: Flow Blockage of Cooling Water to Safety System Components by Corbicula (Asiatic Clam) and Mytilus (Mussel). Mytilus do not inhabit fresh water habitats and thus are not a concern at TMI. The licensee's environmental monitoring program, including biweekly (during spring and summer) benthic samples of the Susquehanna River has not detected Corbicula. Licensee contact with other utilities indicates that although Corbicula inhabits the Susquehanna below TMI it has not migrated to within 50 miles of the station.

No violations were identified.

10. Exit Interview

On July 6, 1982, a meeting was held with licensee representatives (denoted in paragraph 1) to discuss the inspection scope and findings.

ATTACHMENT

SUMMARY OF INDEPENDENT MEASUREMENT VERIFICATION

1. Groundwater Monitoring Program. The licensee samples onsite groundwater by means of test borings (see Figure 1). Weekly water samples are taken from borings 1, 2, 3, 10, 16, and 17. The other test borings are sampled monthly except test boring 9 which is clogged. During April, 1982, the licensee reported analytical results for groundwater samples taken from onsite test borings in February and March of 1982. Changes in tritium concentrations were noted for test borings 2, 3, and 17. A sample taken from test boring 17 on March 23, 1982, contained a tritium concentration of 1,100,000 pCi/l. The previous highest reading for test boring 17 was 678,000 pCi/l, for a sample taken February 25, 1982. Test boring 2, was reported as 954,000 pCi/l, for a sample taken February 12, 1982. More recent samples from test boring 2 showed reduced levels of tritium, down to 30,900 pCi/l for a sample taken March 23, 1982. The tritium levels for test boring 3 went from about 2,400 pCi/l on March 9, 1982, to 24,700 pCi/l on March 23, 1982. The licensee instituted a systematic program to identify the source of the tritium. The NRC independently analyzed water samples taken from these test borings on April 8, 1982.

The maximum permissible concentration (MPC) of tritium in unrestricted areas, as required by 10 CFR Part 20, is 3,000,000 pCi/l. The increased concentrations have remained below MPC. The increased tritium concentrations were only noted in the test borings near the Borated Water Storage Tank. The samples from aquatic environment in the TMI area did not indicate any apparent increase in tritium concentrations.

Location	Licensee Result during February and March 1982 (Tritium Concentration)	NRC Results (Region I) for Samples taken April 8, 1982 (Tritium Concentration)
*TB-2	30,900 pCi/l	40,100 pCi/l
TB-3	24,700 pCi/l	22,000 pCi/l
TB-17	1,100,000 pCi/l	800,000 pCi/l

*TB - Test Boring

2. Borated Water Storage Tank Leak. On Wednesday, January 13, 1982, a leak was discovered from a 3/8 inch instrument line connected to the Borated Water Storage Tank (BWST). The tank contained a mixture of pre-accident Unit 2 water, water transferred from the Unit 1 BWST in March 1979, and some processed auxiliary building water from EPICOR II. The predominant radionuclides in the water include:

Cs-137	3.7×10^{-4} uCi/ml
Cs-134	1.1×10^{-4} uCi/ml
Co-60	1.3×10^{-5} uCi/ml
H-3	9.02×10^{-2} uCi/ml

Since January 1982, groundwater near the borated water storage tank (BWST) had apparently leaked into underground structures in the vicinity of the BWST (Air Intake Tunnel and BWST Pipe Chase). As part of the monitoring program, a detailed characterization of the isotopic makeup of the contaminated water in the air intake tunnel and the borated water storage tank (BWST) was conducted. The additional analytical results indicated minute concentrations (6×10^{-8} uCi/ml) of Sb-125 in the BWST pipe chase and the air intake tunnel. A more sensitive analysis of water from the BWST indicated an Sb-125 concentration of 6.5 E-6 uCi/ml. Preliminary evaluation of the analytical results indicated that the Sb-125 to tritium ratios in the air intake tunnel were consistent with those in the BWST. This ratio indicated that the probable source of radioactivity in the groundwater was from the BWST. Although difficult to quantify, it appeared that the leakage of BWST water was approximately 3,000 gallons.

Environmental Protection Agency, Middletown Laboratory Results
(sample taken 4/16/82)

Location		
BWST Pipe Chase	2.6 E-7 uCi/ml (Sb-125)	8.7 E-3 uCi/ml (^{3}H)

3. Reactor Building Integrity Assessment Program. The licensee monitoring of the onsite groundwater is part of a program which began in early 1980 to assess reactor building integrity.

Besides the reported tritium levels (see above) the licensee detected minute quantities of cesium in some of the test borings during 1981.

Date	Location	Cesium-137	Cesium-134
Feb. 1981	TB-2	370 pCi/l	135 pCi/l
Nov. 1981	TB-2	35 pCi/l	Not Detected

Samples taken by the NRC from TB-2 on February 8, 1981, were tested by the EPA (Middletown Laboratory)

Location	Cesium-137	Cesium-134
TB-2	170 ± 18 pCi/l	68 ± 13 pCi/l

Another onsite location sampled was the East Dike Catch Basin (EDCB). Tritium concentrations at this location remain above background.

Composite samples from each of the test borings and the EDCB are being analyzed quarterly for radioactive strontium by the licensee. An analysis of samples collected from April 1, 1981 to June 24, 1982, indicated that strontium was below detectable limits in all monitoring locations except the EDCB. The composite sample from the EDCB indicated a strontium 90 concentration of approximately 1 pCi/l (slightly above the lower limit of detection).

Date	Reporting Group	Result
4/24/81	DOE (Idaho)	2 ± 2 E-7 uCi/ml (H-3) 1.0 ± 0.8 E-9 uCi/ml (Sr-90)

More recent sample results follow:

2/82	GPU	520 ± 80 pCi/l (H-3)
2/82	GPU	840 ± 120 pCi/l (H-3)
2/82	EPA (Middletown)	Average 600pCi/l ± 250 (H-3)

No cesium or strontium radionuclides have been detected in the EDCB to-date during 1982.

4. Special NRC Sample Program. During March and April 1982, the NRC sampled various onsite locations (Figure 2) to assess BWST leakage/cleanup, and the licensee monitoring program. Soil and liquid samples were tested by the Analytical Chemistry Laboratory, Idaho Operations Office, DOE. The results of these analyses are reported in the following table.

Sample #	Type and Location	3H uCi/gm	Gross Beta uCi/gm	90Sr uCi/gm	Gamma Scan uCi/gm
1	Soil; East of PWST Pump House	(-9 / 9) E-7	(1.7 / 0.4) E-5	(-7 / 7) E-8	1.40 E-7 Cs-137 2.21 E-8 Cs-134
3	Soil; SW of PWST #2	(0 / 9) E-7	(1.8 / 0.4) E-5	(1 / 8) E-8	-1.32 E-8 Cs-137 1.95 E-8 Cs-134
4	Soil; North of PWST #1	(-9 / 9) E-7	(1.5 / 0.4) E-5	(-2 / 8) E-8	1.27 E-7 Cs-137 1.93 E-8 Cs-134
5	Soil; NE of Unit 2 BWST	(0 / 9) E-7	(1.7 / 0.4) E-5	(1.7 / 0.9) E-7	1.76 E-7 Cs-137 2.41 E-8 Cs-134
6	Soil; West of Unit 2 BWST	(5.77 / 0.17) E-5*	(1.7 / 0.4) E-5	(-4 / 8) E-8	1.45 E-6 Cs-137 4.44 E-7 Cs-134
7	Soil; South of Unit 2 BWST	(-9 / 9) E-7	(1.5 / 0.4) E-5	(9 / 8) E-8	1.43 E-6 Cs-137 4.04 E-7 Cs-134
8	Soil; Control - Hbg. Int. Apt.	(-18 / 9) E-7	(2.8 / 0.4) E-5	(1 / 8) E-8	3.38 E-7 Cs-137 -8.50 E-9 Cs-134
9	Soil; Control - 1 mi. North of TMI	(0 / 9) E-7	(1.8 / 0.4) E-5	(1.9 / 0.8) E-7	2.28 E-7 Cs-137 1.72 E-8 Cs-134

*Indicates Positive Result

MAY 4, 1982

FIGURE 1

TEST BORING H^3 CONCENTRATIONS

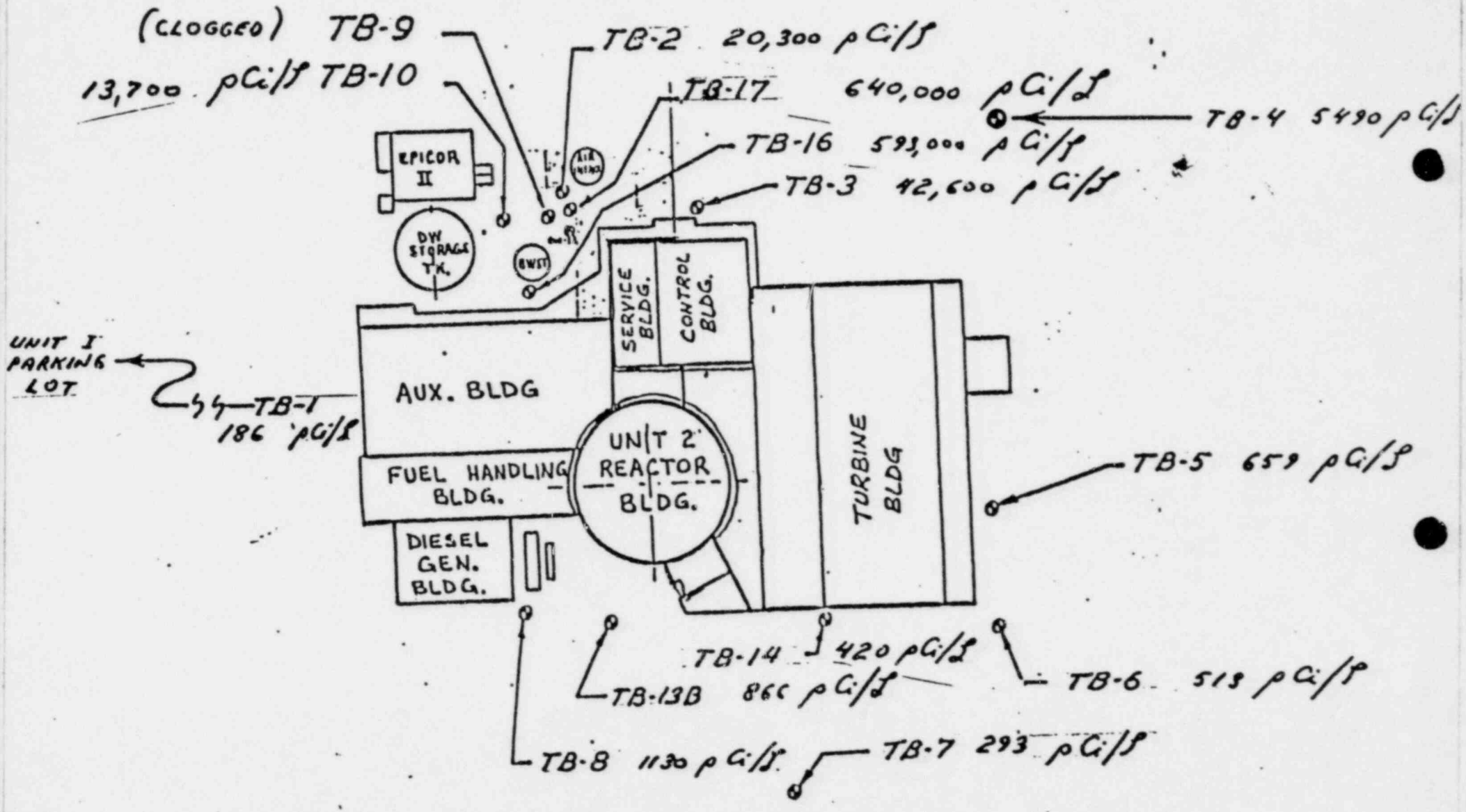
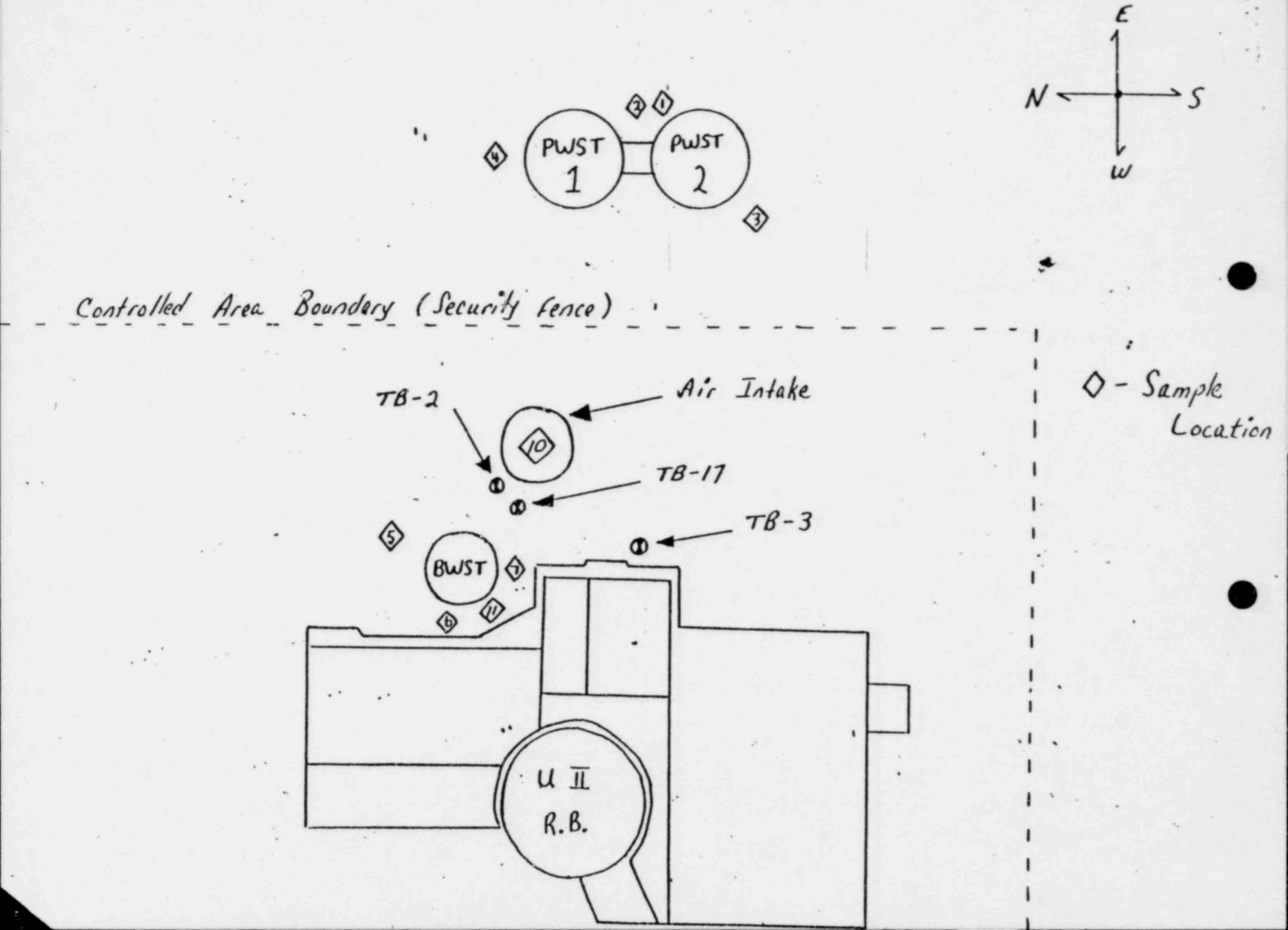


FIGURE 2


E
N
S
W
PWST 1
PWST 2
1
2
3
4
Controlled Area Boundary (Security Fence)
TB-2
Air Intake
10
TB-17
TB-3
BWST
5
6
7
11
U II
R.B.
◇ - Sample Location